Zero Retries issue 0171 2024-09-27

Zero Retries is an independent newsletter promoting technological innovation that is occurring in Amateur Radio, and Amateur Radio as (literally) a license to experiment with and learn about radio technology. Radios are computers - with antennas! Now in its fourth year of publication, with 2100+ subscribers.

About Zero Retries

Steve Stroh N8GNJ, Editor

Jack Stroh, Late Night Assistant Editor Emeritus

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Web version of this issue - https://www.zeroretries.org/p/zero-retries-0171

Request To Send

Commentary by Editor Steve Stroh N8GNJ

Paid Subscribers Update

My thanks to **Merik Karman VK1DF / VK2MKZ** for *renewing* his *second* **Founding Member Annual Subscription** to Zero Retries this past week!

Founding members are listed in every issue of Zero Retries!

My thanks to **Prefers to Remain Anonymous 12** for *renewing* as an **Annual Paid Subscriber** to Zero Retries this past week!

My thanks to **Phil Marquis K6HSV** for *upgrading* from a free subscriber to an **Annual Paid Subscriber** to Zero Retries this past week!

K6HSV said *"Beats the heck out of reading QST."*

My thanks to **Jeffrey Komori KH6JUZ** for becoming an **Annual Paid Subscriber** to Zero Retries this past week!

My thanks to **Prefers to Remain Anonymous 51** for becoming an **Annual Paid Subscriber** to Zero Retries this past week!

My thanks to **Prefers to Remain Anonymous 52** for becoming an **Annual Paid Subscriber** to Zero Retries this past week!

Financial support from Zero Retries readers is a significant vote of support for the continued publication of Zero Retries.

Upcoming Events Countdown

Pacificon 2024 in San Ramon, California, USA on 2024-10-18 thru 20 in *3 weeks*. Tina KD7WSF and I plan to attend Pacificon 2024 (which makes it "major" to us).

My presentation at Pacificon 2024 - **Tracking Technological Innovation in Amateur Radio** will be on Saturday 2024-10-19 from 16:00 - 16:50 in Contra Costa Salon 2.

See the **Zero Retries Guide to Zero Retries Interesting Events** for additional events.

My FCC Docket 24-240 Reply Comments *Filed*

Well, I got my Docket 24-240 Reply Comments submitted, but I did so after business hours in Washington DC, *but still well within "2024-09-20"*. I wasn't quite sure if my submission would be considered to have been submitted that day, but the timestamp on my submission, processed the next business day (2024-09-23) says 2024-09-20, and the status of my submission says

Filing Status DISSEMINATED

So I think my Reply Comments will be duly considered.

Comments are *still* coming in (more than 1800 now), nearly a week after the 2024-09-20 deadline, and those late comments are being marked as DISSEMINATED.

NextNav isn't dissuaded by the thousands of negative comments. Their Reply Comment said, in part:

> The Commission will of course carefully consider the feedback from all commenters, as will NextNav, but the key takeaway is this: No one else has proposed a credible solution to the widely recognized and increasingly urgent problem that the United States has no widescale TPNT service to complement and back up GPS where the GPS signal is obstructed or when outages occur. Even many of those opposed to NextNav's Petition acknowledge that a terrestrial complement and backup to a satellite-based PNT service is critically important to safeguarding U.S. national security, public safety, economy, and way of life. As there is no prospect of the U.S. government funding a standalone terrestrial PNT network, NextNav offers the only concrete opportunity to enable a widescale terrestrial PNT service—one that has a clear path to availability in consumer devices such as cellphones—without spending taxpayer dollars.

NextNav is really disingenuous here - there *were other* "credible solution[s]" discussed in the submitted comments. NextNav's proposal is *not* the only credible *potential* solution to this issue. I, for one, think we should rebuild the LORAN (eLORAN) system.

I've been amazed before, and this is yet another example, of the seemingly inexhaustible budgets available to communications law firms to aggressively lobby the FCC when there's a credible prospect of getting the FCC to (however reluctantly) agree to allocate "free spectrum". If the FCC declines NextNav's proposal… they (or a successor, who buys NextNav's assets out of bankruptcy) *will be back*, eventually.

Some Zero Retries readers from outside the US wrote to me basically saying:

> What a screwed up system the US has with the FCC when a private company with a specious claim, who hasn't really done anything to prove out their technology claims, can credibly threaten to bankrupt hundreds of companies and obsolete billions of devices.

I couldn't offer any argument to their assessment.

Have a great weekend, all of you co-conspirators in Zero Retries Interesting Amateur Radio activities!

Steve N8GNJ

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Dewayne Hendricks WA8DZP is a Silent Keyboard

By Steve Stroh N8GNJ

A remembrance of my very smart, and kind friend and mentor, Dewayne Hendricks WA8DZP.

Since this article will likely be shared outside of Amateur Radio (also called Ham Radio), when an Amateur Radio Operator has died, they are referred to as a Silent Key (SK). This terminology dates back to the very early days of Amateur Radio when communications were conducted *solely with Morse Code*, by tapping on a Morse Code key. Thus, when an Amateur Radio Operator dies, their "key goes silent". In the more modern form of Amateur Radio that Dewayne and I were involved with, using data communications technology, "Silent Key" is archaic. Thus in Zero Retries memoriams, I began using the terminology "Silent *Keyboard*" in such situations, since data communications folks generally make more use of keyboards than Morse Code keys.

Dewayne was an incredibly smart person, with amazing bandwidth and mental stamina. In my decades of knowing him, our interactions and conversations were generally about radio technology (Wireless Internet Access), Amateur Radio, Internet access, regulatory issues, and various other issues.

Years before I met him, I knew of Dewayne by reputation as one of his early notable accomplishments in the early Amateur Radio Packet Radio era in the 1990s was was to port KA9Q's "NOS" TCP/IP package (originally written for MS-DOS) to the Macintosh in the "Classic Mac" era, which was (I think…) the first implementation of TCP/IP running *on* the Mac. There was… nothing… in common between those two different types of computers in that era. Thus Dewayne's accomplishment of making KA9Q NOS became legendary to those of us in Amateur Radio who understood how challenging that project was.

Along with TAPR President Greg Jones WD5IVD (another, *way too soon* Silent Keyboard), Dewayne was instrumental in TAPR's "focus on the future" in the late 1990s as illustrated in this prescient paper - A New Vision for the Amateur Radio Service. At the time, many of us "digital enthusiasts" in Amateur Radio wanted to experiment with more modern, digital types of radio technology and the FCC rules severely restricted such experimentation. Dewayne, and later TAPR, was involved with a "Special Temporary Authority" by the FCC to conduct testing that ordinarily would be outside FCC's regulations for Amateur Radio. The results of that testing eventually justified some relaxation of the strict rules against using such digital technology in Amateur Radio.

I first met WA8DZP at the 1996 Digital Communications Conference in Seattle, Washington when he was the featured speaker for the Sunday "Deep Dive" technical seminar. WA8DZP would be explaining about the (then) new unlicensed "Part 15" wireless networking devices that were becoming available and could potentially be repurposed for Amateur Radio use. (This was way before 802.11 or Wi-Fi made such devices common.)

Dewayne subtly revealed his intense interest in Science Fiction to us at that conference. His "outfit" at the conference unremarkable - a black pullover sweatshirt, notable only because of the life-size (and looking totally authentic) Star Trek (the Next Generation) Starfleet logo "communications badge" on his upper chest. That… and Dewayne wasn't willing to be taken to the nearby Kinko's 24 hour copy shop to download his presentation handout for printing until after he had watched the first episode of a new science fiction television series called "Dark Skies". Given that that show came on at 9:00 or 10:00 that evening, my wife Tina got irritated at that delay and told me:

"I'm going home to my daughter. *You* deal with him."

At the Kinko's, because of the late hour, there was a church bulletin for a large church that had to be completed before they could work on Dewayne's handouts that we would need on Sunday morning. So we waited for about an hour and we started talking about his presentation subject, "Part 15" radios. I listened attentively… but I couldn't quite believe the claims Dewayne was making about the capabilities (and the relatively low cost) of these new types of radios.

After seeing Dewayne's presentation on Sunday, I still felt that his claims were a bit too good to be true, based on my extensive background in Amateur Radio Packet Radio. I was highly skeptical that "1 watt, 20 miles, 1 Mbps, on 902-928 MHz" was doable without extraordinary effort like using large, focused dishes to achieve that level of performance.

One of the reasons I was skeptical about Dewayne's claims was that I was a voracious reader of all kinds of computer periodicals, and I had not heard of such devices in my reading. But, I was lucky that my employer at that time had access to the pre-commercial Internet and I could use the NCSA Mosaic web browser to look up the companies and products that Dewayne mentioned. WOW, he was right! He wasn't exaggerating his claims about those Part 15 devices, and the reason that I wasn't reading about these products was that these companies were selling all the products that they could make, and they didn't (then) need to advertise to the computer industry.

After that experience, I dived deep into learning about this new type of radio technology. I became mildly obsessed about the subject, and when I spotted a request for writers about the new "public" Internet, and Internet access technologies, I offered to write a monthly column on "Wireless Internet Access".

It was a long and winding path from that weekend, to becoming a writer about radio technology, and most recently, Zero Retries, this newsletter about technological innovation that's happening now in Amateur Radio. But, looking back, it's easy to place the primary "pivot point" of my becoming a writer back to that weekend when I had my mind blown that an entirely new level of radio technology had become possible… that I became intensely interested in, thanks to Dewayne. Wireless Internet Access is completely normal now, and even a small industry (Wireless Internet Service Providers - WISPs). But back then, it was very novel, very bleeding edge, and learning about it early, thanks to Dewayne, was "my writing ticket".

In that era, Dewayne was in demand as a Subject Matter Expert on broadband wireless technology (that wasn't cellular telephony). Dewayne's influence in that industry extended to his appointment to the Technological Advisory Committee at the FCC where his opinions were carefully considered - the FCC was literally asking for Dewayne's opinion. Dewayne lived in Fremont, California where the "Broadband Wireless Internet" industry was in full swing. In my writing, I was tracking dozens of companies developing unique radio technology, and whenever I mentioned one to Dewayne, he was already aware of it. I was envious of Dewayne's access to the very early broadband Internet via the first @Home "cable Internet" system which provided 10 Mbps *symmetric* Internet access. Dewayne was also was an early user of the Metricom wireless Internet access network, which was first deployed in Silicon Valley.

One of the most unique aspects about Dewayne making presentations about Broadband Wireless technology (and he made a *lot* of such presentations), was that he *always* worked Amateur Radio into the presentation and presented having an Amateur Radio license as an entry into using Amateur Radio spectrum as a "proving ground" for experimental radio systems. He told me of many radio "experiments" conducted in Silicon Valley… some of them are better left unmentioned even now.

One of Dewayne's mentors about radio technology was Paul Baran who was a very influential technologist who founded two influential companies - Metricom and Com21. Metricom used the 902-928 MHz band for wireless Internet access using "microcells" clamped to streetlights. Com21 was an early manufacturer of what's now known as cable modems. One of Dewayne's technology insights for Amateur Radio was that Com21's cable modems were one of the earliest implementations of Software Defined Radio technology - a data radio whose characteristics could be changed with a few software commands, rather than changing the hardware of the radio. Dewayne worked for Com21 briefly and had some test units made to prove out his theory, and they worked as he expected (some of the "experiments" I referenced), but Com21 was uninterested in making products for Amateur Radio.

Dewayne's professional exploits are now the stuff of legend, and he was profiled in Wired Magazine (practically the equivalent of a knighthood in tech circles in that era) in a January 2002 article titled "Broadband Cowboy" - https://www.wired.com/2002/01/hendricks/ Dewayne's various "wireless Internet" projects took him to Mongolia, to Tonga, and to Native American reservations. Dewayne stated to me once that he was part of a group that met with President Bill Clinton in the oval office to brief President Clinton on the (then) new "Internet". (I never had the nerve to ask him if he "dressed up" for that meeting.)

Others have done a far better job of explaining Dewayne's many professional interests and kindnesses beyond my interactions with him. David Rosenthal did the the most complete telling of Dewayne's accomplishments (beyond the Wired article) that I've seen to date - https://blog.dshr.org/2024/09/dewayne-hendricks-rip.html.

Dewayne was a fan of the Apple Macintosh (and, if memory serves, worked at Apple for a while) especially after they began making "laptops". The first "luggable Mac" I saw Dewayne with at an Amateur Radio conference was huge and heavy… but he had his computer with him and most of us had to leave our (desktop) computers at home. I was a much later convert to the Mac, and so when Apple did their periodic "reveals" of new systems, Dewayne and I exchanged our impressions. Most recently we were both impressed with Apple's Vision Pro augmented reality headset. I mentioned a project I'd read about to create a *full* virtual model of the USS Enterprise (original series) for the eventual development of a good enough virtual reality headset - like the Vision Pro. The idea of "virtual Enterprise" was that you could wander the *entire ship in virtual reality* (which of course, was never possible in real life as only a few selected portions of the ship were ever built as full scale sets). I told Dewayne that as soon as "virtual Enterprise" was available, I would buy a Vision Pro just for that. Dewayne was equally enthusiastic and said that he would buy one also.

With all of Dewayne's many personal and professional accomplishments, I was always humbled by his acceptance of me as a peer. He would always take my call or reply to my emails. In the decades since that fateful Sunday in 1996, Dewayne and I became friends and confidants, sharing our respective insights about radio technology, Amateur Radio, regulatory issues, and general technology, and life.

I learned late in our relationship that Dewayne devoted significant time in his life to mentor young folks through The Mentor Project - https://mentorproject.org. For more than a decade, he had relocated from Fremont, California to his family home in Detroit to help his elderly mother, and his mentees were both virtual and in-person. For decades Dewayne curated an email list called Dewayne-Net - https://dewaynenet.wordpress.com where he mentioned interesting and/or important, or occasionally just funny or interesting science fiction articles to a list of many *significant* people. It was amazing to see some of the reply comments he would get that he would include in a later issue of Dewayne-Net. It was a rare "score" for me that something I suggested to Dewayne was mentioned on Dewayne-Net… and it was so cool that he referenced my contribution "from friend Steve Stroh".

One of the very few things that I "beat" Dewayne to in "advanced Amateur Radio" was my involvement with Amateur Radio Digital Communications (ARDC) - https://www.ardc.net, which is an organization that makes grants to Amateur Radio projects, research and development, and most notably scholarships. I began working with ARDC on their Grants Advisory Committee in 2021 and talked about it a lot to Dewayne. Dewayne became very interested in ARDC's work and applied and was accepted onto the same committee in 2022, and he just completed his three year term at the end of 2023. One of the most memorable things that was mentioned about Dewayne when I talked to other folks at ARDC about his passing was Dewayne's habit of when we would vote to recommend a grant proposal for funding, most of us said "Aye" or "Yes". Dewayne would always say "Make It So!" which was a oft-uttered phrase of Captain Picard of Star Trek The Next Generation. ARDC's remembrance of Dewayne is now online - https://www.ardc.net/remembering-dewayne-hendricks-wa8dzp-sk/

One of the lasting legacies of Dewayne on my life was making introductions for me to a group of very smart people who prefer not to be named or publicly acknowledged (not for any bad reasons - they just prefer to interact with each other confidentially). Dewayne was deeply embedded in that group from the very beginning, and that group has been a very informative part of my life that continues to enrich my life, personally and professionally.

In July 2021, I "pulled the trigger" on a wild experiment I called Zero Retries Issue 0000. It went out to a very small group of folks who I had alerted about it. Dewayne was one of the earliest, and *the* most impactful "cheerleader" when I began Zero Retries. Dewayne didn't want to be publicly acknowledged - he preferred to remain in the background. I am forever indebted to Dewayne for his early, enthusiastic influence on Zero Retries and sharing his very broad and deep knowledge and perspective. Dewayne was usually the first to click "Like" when I published each issue of Zero Retries and he told me that he waited eagerly for each new issue (and missed it when I was occasionally late in publishing). I will miss seeing that "Like" show up, often within minutes of auto-publishing at 15:30 Pacific.

Dewayne's "Keyboard went silent" last Friday 2024-09-20, painlessly I'm told, after a brief illness. I'm blessed that I talked to him the previous day and was able to tell him how grateful I was for his friendship and acceptance as a peer, and all the times he helped me along in my writing career.

I also told him, in total sincerity, that he had made his own unique dent in the universe, that only he could have done, and that I was blessed to be his friend. He chuckled at that, and thanked me.

In our talks, Dewayne got me to commit to doing three things that I have yet to complete… but now they're a priority. The first is to get my Amateur Radio Extra license (I'm currently a General). The second is to visit the Henry Ford Museum of American Innovation in Dearborn Michigan. Despite growing up in Ohio, just a few hours away, I never have made the time to visit it, and Dewayne was a *fanatic* fan of it. Third, read Isaac Asimov's Foundation series… *all* of it. I started it after the new (Apple) television series and found it dense going. Dewayne sputtered at me when I begged off "Steve - we're *living* in Empire *now*". Only fans of Foundation will understand that remark.

I will profoundly miss my friend Dewayne.

I wish you had Live(d) Long(er) and Prosper(ed) (more), Dewayne! 🖖

WA8DZP from N8GNJ… 73 and QRT.

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A 144 / 222 / 440 MHz 9600 APRS Stack… and Network!

By Steve Stroh N8GNJ

I discovered a Zero Retries Interesting project in progress, by a highly motivated fan of APRS, to build a network of 144 / 222 / 440 APRS digipeaters on

the island of Oahu in Hawaii, USA.

My discovery started with a post by Ron Kochanowicz on the Facebook Group 220 MHz Radio Group:

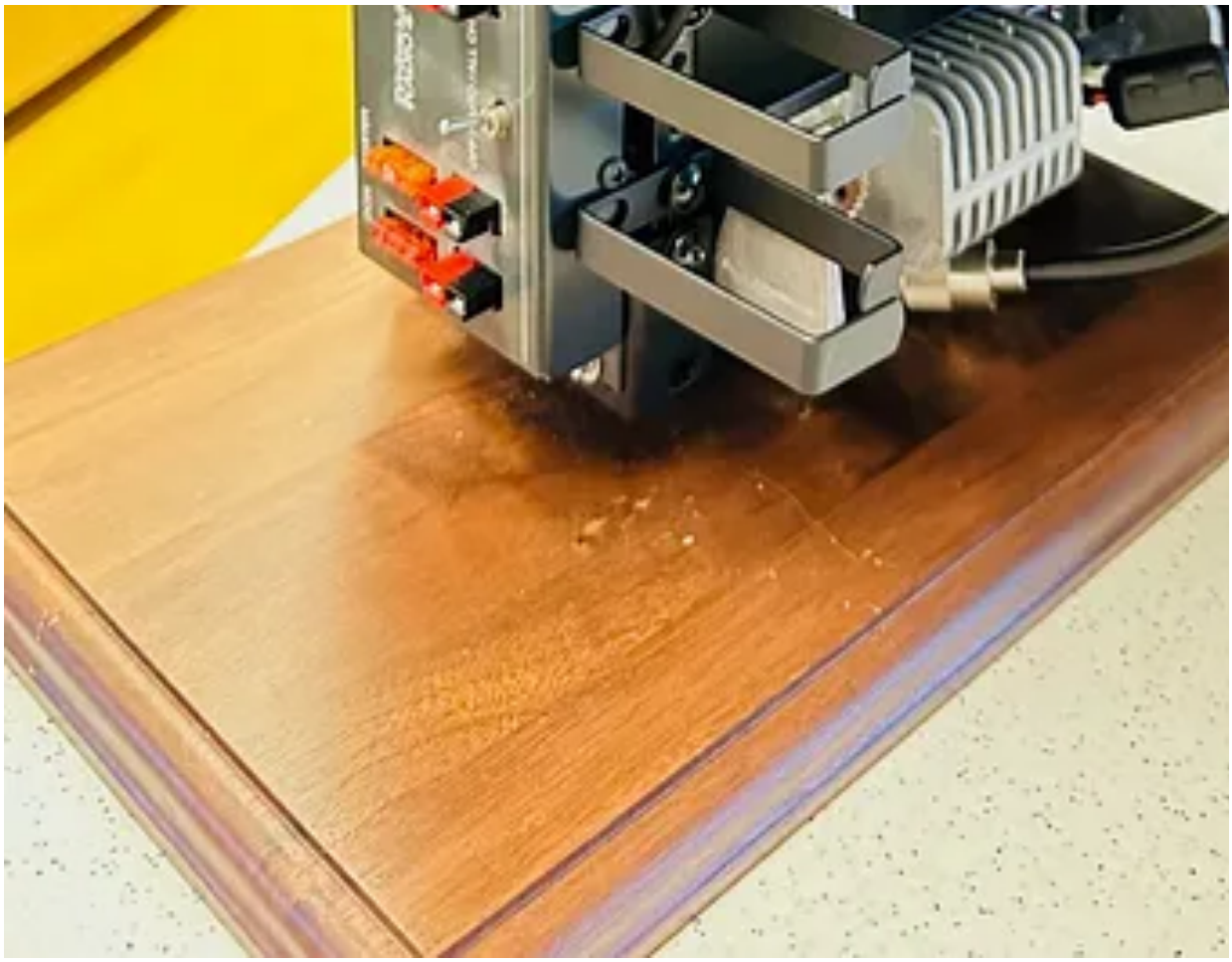

Image courtesy of Jeff Komori KH6JUZ

> Jeffrey, KH6JUZ, is bundling a BCM-220 with his 70cm and 2m rigs to build these awesome APRS stations. This [is] being deployed in Hawaii on Oahu. This is really cool to see.

Kochanowicz also links to Bridgecom Systems blog post and a YouTube video (below) with a brief interview of KH6JUZ about his goals with this project:

I had intended this to be a brief ZR > BEACON mention, but I was able to get in touch with the creator of the project, Jeffrey Komori KH6JUZ. We had a delightful 90 minute conversation about his project, and we're of the same generation and both of us had extensive experience with Amateur Radio Packet Radio technology back in the 1990s and early 2000s. Thus I have a lot more background information to make this a full article.

The goal of the KH6JUZ's project is to improve APRS coverage on the island of Oahu, Hawaii, USA with a network of these units providing APRS service on 144.39 MHz at 1200 bps, and 9600 bps APRS service on the 144, 222, and 440 MHz bands.

This project has been underway for about two years now, with prototype units deployed with various radios, modems, etc. That research has resulted in this configuration, now being built en masse by KH6JUZ.

Each unit consists of:

- Customized short rack to keep the installation "clean"
- Two Bridgecom Systems BCM-144 radios1
    - One on 144.39 MHz operating at 1200 bps
    - One on 144.99 MHz operating at 9600 bps
- 144 MHz duplexer to combine the two 144 MHz radios into the same antenna (port)
- Bridgecom Systems BCM-220 radio on 223.65 MHz operating at 9600 bps
- Bridgecom Systems BCM-440 radio on 443.10 MHz operating at 9600 bps
- Antenna triplexer to feed a Comet CX-333 (144 / 222 / 440 MHz) omni antenna
- Four Masters Communications DRA-45M modems
- Custom cable between the radios and the DRA-45Ms
- Raspberry Pi running DIRE WOLF Software TNC
- West Mountain Radio RIGrunner 4010S+ power distribution (chosen because it has a low voltage cutout function). This unit can be configured via USB for remote monitoring / reset.
- West Mountain Radio Epic PWRgate for uninterruptible power with a 12 volt battery
- Raspberry Pi 5 with CPU cooler, powered by a 12V to USB (3A) adapter, with USB-A to USB-C adapter. For maximum flexibility and future expansion, the 8 GB RAM version of the RPi 5 was chosen, and for storage, a 256 GB Micro SD card. While very little storage is required, and the wear leveling feature of the 256 GB card will have "plenty of excess capacity".
- Powerwerx 30A power supply
- (Not mentioned, but assumed given the inclusion of the Epic PWRgate) - a 12 volt backup battery.
- Cisco cellular modem when the site does not have Internet already available, used for remote management and APRS IGate connectivity.

Some of the painful discoveries in the prototyping process:

- The Raspberry Pi 4 has a nasty, known bug that it doesn't handle multiple USB devices very well. The Raspberry Pi 3 doesn't have this issue, but it is still unobtainium. The Raspberry Pi 5 is widely available, so that was chosen.
- The Raspberry Pi 5, at least in this application, doesn't use much more current than the Raspberry Pi 3 or 4… but it won't boot up reliably unless it has a *3A* power supply.
- The Bridgecom BCM radios require unusually high voltage to drive the radio to full 3.5 kHz deviation for most reliable 9600 bps communications. Of the various Masters Communications Digital Radio Adapter (DRA) units, the DRA-45M has an option for external 12 volts input to be able to drive the BCM radios to full 3.5 kHz deviation.
- Consumer grade cellular modems had various issues, including not powering up when power is lost, then restored, despite being configured to do so.

This is a cool, clean installation and it's one of the few examples I've seen of using the flat audio capability of the Bridgecom BCM radios for higher speed data such as 9600 and VARA FM. That the BCM series is a capable data radio, and is one of the few single band radios with standard flat audio… is slowly filtering into Bridgecom Systems, and there is growing awareness at Bridgecom Systems of the market for the BCM series as *data* radios.

Another photo on the Facebook post showed at least *eight* such stacks under construction, and in our conversation KH6JUZ confirmed that number, which doesn't include the prototype units already deployed. As these units are completed and installed, the prototype units will be brought back and the usable bits of the prototypes will be reused for new units.

One of the improvements made possible by using DIRE WOLF is that each unit will be transmitting with FX.25 Forward Error Correction (FEC), which is backwards compatible with AX.25 for user access. If the user is also using FX.25, the connection is more reliable.

The deployment of these final design units is planned to begin in the next few months. In the initial stages, the "backbone" will be the Internet connection for management and the APRS IGate connectivity. But once all of the units are deployed and connectivity tests between them can be conducted under real use conditions, it's possible / likely that the units can be linked on the 222 MHz radio channel, including the IGate traffic, thus removing the requirement for the cellular modems. If connectivity on 222 MHz is usable, then the 222 MHz channel will be converted from user access to restricted linking. Because there's then no need for backwards compatibility with AX.25 for user radios, the 222 MHz radios will be switched to (more efficient, lower overhead) IL2P Forward Error Correction (FEC).

There are many things possible with this system beyond the primary mission of providing APRS coverage of Oahu for residents and tourists. One of my suggestions was that in the wee hours when the system would not be highly utilized, a cron job could be started up to run FLAMP every hour or half hour (let the radio cool off) to distribute files to receive-only remote users, such as bulletins, updates of repeater frequencies, meeting notices, etc.

I was really impressed with the hard work (research) and equipment choices that went into these units by KH6JUZ and I look forward to staying in touch with him as he begins the deployment of these units in the next few months. And, perhaps… an in-person visit to Oahu to see them in action in the dreary months of the Pacific Northwet.

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NinoTNC Firmware Updates

By Nino Carrillo KK4HEJ

Nino Carrillo KK4HEJ, posting to the Ninotnc email list:

Here's an over-due update of recent NinoTNC firmware features.

The latest firmware is version 3.41 for 256k dsPIC chips and 4.41 for 512k dsPIC chips. These are functionally identical firmwares, compiled from the same source, with allowances for the architecture differences between those two variants of dsPIC.

QPSK 3600 Mode

In May, I added a new operating mode called QPSK 3600. This is designed to maximize data rate through an FM radio that lacks a "data port". In other words, you can use QPSK 3600 through the speaker/mic connections of normal FM voice radios.

QPSK 3600 applies phase modulation to an audio carrier. The audio carrier tone is 1650Hz, modulated at 1800 symbols per second. The symbol transitions are RRC filtered with roll-off rate 0.3. This scheme puts the majority of the audio energy between 500Hz and 2800Hz, which should pass through the voice filtering networks in most FM radios.

QPSK 3600 is found on the NinoTNC at switch position 0101 since version .39, and uses IL2P+CRC encoding. The QPSK phase transition map is the same as the other QPSK modes on the TNC, and can be found in the IL2P spec document. QPSK 3600 mode was mentioned in a recent Zero Retries article.

Improved QPSK Demodulator

In version .40, I improved the QPSK demodulator algorithm for better performance. The Costas Loop will now sync slightly faster, and is more tolerant of frequency mismatch errors. This was accomplished by changing the Costas Loop architecture to use complex carrier recovery through a Hilbert Filter applied early in the demodulation process. For those interested, this paper is a good reference on Hilbert Filters.

C4FSK Fast Modes for Data Radios

I added two C4FSK modes in version .40 as well, but they became much more useful in version .41 with the addition of some active equalization in the receive algorithm. C4FSK 9600 mode uses 4-level modulation at 4800 symbols per second to allow 9600 bits per second (gross) through a narrow 12.5kHz FM channel. C4FSK 19200 mode uses the same scheme at 9600 symbols per second to allow double the bit rate through a wide 25kHz channel.

Both of these modes need better signal and path conditions than the 2-level FSK waveforms at the same symbol rate. The level transitions are gaussian filtered to reduce occupied bandwidth. They also use IL2P+CRC encoding. I developed these waveforms with Jon G4KLX, who plans to implement them on the MMDVM-TNC as well.

These modes require radios that have a 'data port' or '9600' connection for the TNC. C4FSK 19200 has been successfully used on-air with Tait TM-8100 series radios. C4FSK 9600 has been successfully used with Taits as well as modified FTM-3100 radios. I expect there are others that will work, but that's our experience to date.

SETHW KISS Command for Remote Mode Change

In version .41 I also added the ability to change the TNC operating MODE remotely with a KISS command. To enable this feature, all the MODE switches need to be in the up position (1111). The KISS command is SETHW (0x6), followed by the mode number. The selected mode will be saved in non-volatile memory. There is an option to disable the NVM save as well. More about this can be found in the Operators Manual at the bottom of section 4.

The latest firmware usually also includes minor bug fixes and other performance improvements, so I generally recommend upgrading. You can find firmware hex files, the updater script, and update instructions here. Please read the instructions. TARPN users can update with the 'tarpn flash' command.

…

Tadd Torborg KA2DEW posted a reply:

> The NinoTNC Operator's Manual should be up to date:
>
> https://tarpn.net/t/nino-tnc/n9600a/n9600a_operation.html

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ZR > BEACON

By Steve Stroh N8GNJ

Short mentions of Zero Retries Interesting items.

Handie-Talkie or Walkie-Talkie?

Bob Witte K0NR on The KØNR Radio Site:

> In ham radio, we often use Handie-Talkie or HT to describe a compact, handheld transceiver. My first exposure to the term Handie-Talkie was when I became a licensed radio amateur in 1977. As a student at Purdue University (W9YB), the absolute coolest VHF radio to have was the Motorola HT-220. Even a used one commanded a high price so they were out of my price range and I never owned one. These were 6-channel crystal-controlled transceivers…back then you had to set up the radio with the particular 2m frequencies you wanted to use. Because it was such an iconic radio, there are many HT-220 enthusiasts still around with websites with tons of useful information. See the HT-220 Page.
>
> Motorola trademarked the name Handie-Talkie and used that nomenclature for many years with its line of portable radios. However, this trademark has expired, so now Handie-Talkie is a generic term.

K0NR dives satisfyingly (Zero Retries Interesting) deep into the history of Motorola "portable" radios and the history goes back to World War 2 and "Walkie" Talkie actually refers to the backpack mounted radios. I wasn't aware that Handie-Talkie is now, officially, a generic term with the expiration of Motorola's trademark.

I too, in the day, lusted after the elegant form factor and the advanced (for the day) capabilities of the HT-220, but never ended up owning one as technology had moved on from the HT-220's capabilities by the time I could consider purchasing a well used unit. The HT-220 was truly a great portable radio, and those among my Amateur Radio friends that had them, *really* loved them!

Video - Setup IP Network over Packet Radio with IL2P and Direwolf

Billy Penley KN4MKB on his Modern Ham YouTube channel:

KN4MKB also offers the text version of all of this on his blog.

It's fascinating to see "TCP/IP over Amateur Radio Packet Radio" done in this era. I'll spare you my reminiscence of "how we did it back in my day". But the tools KN4MKB has at his disposal are so much better - Linux on any computer, DIRE WOLF for the "TNC" (notably, and smart - he's using the IL2P Forward Error Correction - FEC protocol), and most notably "TNC Attach" to bridge between the KISS TNC functionality of DIRE WOLF and the TCP/IP stack of the computer. He's recommending the use of a Digirig audio interface, which admittedly does have the best support for plug and play cable selection for portable radios.

He's using a modest speed radio link:

> You can also increase the modem speed within dire wolf from the 1200 supplied in the above example configuration. Keep in mind, this is somewhat limited to your digital sound card interface, and radio. Radios that supply a dedicated data jack often support up to 9600 baud. I've found that most radios will be happy with a value of 2400. But this rule has exceptions. Both modems in the network will need the same speed setting. As such, my config usually has "MODEM 2400" as the speed setting as this does well with my RT95.

Video - Tech Minds Review - The FIRST Commercial M17 Digital Radio - CSI CS7000-M17

I am a fan of Matt Miller M0DQW and his Tech Minds YouTube channel. Most of what he posts there is Zero Retries Interesting. Thus, when he posts a new video, it goes to the front of my YouTube suggestions because I almost always begin watching it, even if I'm just taking my brief lunch break at mid-day.

One of the most surprising things about this review is that it explained (the first time that I learned this) is that the unit comes in the box *programmed as a DMR / FM radio*, and you have to update it (pretty laboriously - see the video) to activate its "native" M17 capabilities. Shipping this unit as a DMR / FM radio, and marketing it as an "M17" radio seems a bit disingenuous. But, at least it doesn't require a hardware mod, so there's that. And, to date, there isn't a better "plug and play" unit for M17 at the moment. But it would seem to be so much better if the radio came to the customer as running M17, because that is *the* differentiation of this radio versus a generic DMR / FM radio.

A GEOSAT for North America?

Keith Baker VA3KSF / KB1SF in The Canadian Amateur, September / October 2024:

> **In A Micro GEO?**
>
> Micro GEO satellites are a new class of small geostationary communications satellites inspired by the success of the CubeSat platform for Low Earth Orbit (LEO) satellites.
>
> Micro GEOSATs are around a tenth of the size of traditional geostationary satellites and typically measure just one cubic metre in volume. This smaller size makes them significantly cheaper to manufacture and launch, allowing satellite operators to offer customized regional services (or gap fillers) that would not be financially feasible with larger satellites. As a result, the drafters of the new proposal believe that a payload for Amateur Radio would fit nicely into a Micro GEO and would also allow the greatest possible opportunities for experiments on different bands.
>
> Six bands are now being proposed for the uplink to enable experiments with different frequencies with the 13 cm band (2.4 GHz) uplink being primary with the main downlink in the 3 cm (10 GHz) band. All proposed transponder combinations could be implemented at the ground station.

In Zero Retries, I normally won't mention articles in publications behind paywalls, but this one was really good and worth an exception. I'd happily reprint the entire article, but The Canadian Amateur is a members-only publication2 and is not publicly available.

As VA3KSF / KB1SF explains, inclusion of an Amateur Radio payload in one of the conventional (big, high power) GEO satellites comes at the cost of higher weight to GEO orbit and correspondingly lower amounts of precious stationkeeping fuel for the typical decade or more lifetime of a conventional GEO satellite. Thus an Amateur Radio payload on one of those satellites is a cost, or would be a gift, worth 10s of $millions.

As prelude to the possibility of a North America Amateur Radio GEO payload, VA3KSF / KB1SF provides the some previously unexplained (that I've seen…) backstory of how the Qatar-OSCAR 100 (QO-100) Amateur Radio payload came to be hosted on Qatar's Es'hail-2 satellite in Geosynchronous Earth Orbit (GEO) over Africa.

It's a real frustration that quality content such as this article, that would benefit Amateur Radio as a whole and could help incite significant interest in Amateur Radio, will only ever be seen by a very small number of people who happen to be RAC members. But kudos that TCA *is featuring such Zero Retries Interesting content in their primary publication*; that can't be said of their US counterpart.

And… with even more frustration on "good articles locked behind paywalls", there's an accompanying *12 page article* in the same issue:

> **Exploring New Horizons**
> **First Activation of Newfoundland (VO1) on QO-100 (Es'Hail-2)**

… with great photos and ample technical explanations of the challenges of (just… barely… feasible…) working QO-100 from North America.

Radio Amateurs to Receive Awards From Radio Club of America

John Rech W0PV on QRZ.com Amateur Radio News:

> The **Radio Club of America** has announced its 2024 awardees. Among these are two well-known hams in our technical circles:
>
> Dr. Nathan "Chip" Cohen, W1YW, the **Dr. Arno Penzias Award for Contributions to Basic Research in the Radio Sciences**. Established in 2023, this award recognizes significant contributions to basic research involving RF and related subjects to inspire future generations of scientific professionals. Chip pioneered fractal antennas, invisibility cloaks, and fractal metasurfaces including the science behind them.
>
> Professor James Breakall, WA3FET, the **Dr. Ulrich Rohde Award for Innovation in Applied Radio Science and Engineering**. Established in 2023, this award recognizes significant contributions to innovation in applied radio science and engineering in the wireless industry to inspire future generations of wireless professionals. Jim is a pioneer in NEC and electromagnetic computer simulations and created the OWA Yagi antenna, among others.
>
> The awards will be presented at RCA's banquet on Nov 23.
>
> Congrats to Chip and Jim, and the other winners!
>
> 73, John, WØPV
>
> For more information see: PRESS_RELEASE_RCA_Awards_and_Fellows_2024 PDF

SDR Television

Simon Brown sdr-radio.com:

> **QO-100 Beacon**
>
> SDR Television is a pure software solution for DVB-S2 H.264 / H.265 / AAC digital television. No hardware such as the MiniTiouner is required, just a SDR such as Pluto or Lime if transmit support is required, otherwise even a RTL SDR suffices.
>
> Here's a recording showing SDR Television playing content from the geostationary QO-100 beacon. This software is still being developed, tentative preview date before February 2025, official preview April 2025.
>
> - CPU load is low - typically 2% or less of an i5-13600F
> - MER is around 10 dB
> - Diagnostic display show key decoding status values
>
> Much more to come over the next weeks and months including transmit support.

We've become accustomed to Software Defined Radio… as a system for *radio*. and we're pretty parochial about "radio" meaning narrowband and slightly less narrowband (1 Mbps or so) *data*.

As long as I've been following (peripherally… I haven't done a deep dive in quite a while) Amateur Radio Television[3] *analog, and digital*, has required specialized (at least somewhat expensive) hardware. The analog "6 MHz radio" has given way to dedicated video chipsets for compressing the wide bandwidth video signal down to the minimum necessary channel. *Until this*.

But no more - this is *just software*.

> SDR Television is a pure software solution for DVB-S2 H.264 / H.265 / AAC digital television. No hardware such as the MiniTiouner is required, just a SDR such as Pluto or Lime if transmit support is required, *otherwise even a RTL SDR suffices*.

A few caveats, as I understand the above:

1. *SDR Television* will be another mode added to SDR Console.
2. It's a Windows application (only - aggressively4)
3. There's no indication that it's open source, only distributed freely with a "use for free if you're an Amateur Radio Operator" blessing.

So there's no easy "porting" of this to any other systems. But… *now that we know* that Digital Amateur Radio Television (DATV) is possible on really minimal hardware.

Here's a bit of my "Mind Blown" moment reading this:

With this, Amateur Radio can be offering Amateur Radio video content…
on Amateur Radio. Cheap. Easy (enough).

What I'm imagining is that every large regional or big city Amateur Radio organization ought to be working to get a Digital Amateur Radio Television (DATV) repeater on the air. Then it would be pretty easy to set up kits of preconfigured RTL SDRs systems out there in the world for use with kids. If the repeater is a powerful one on, say 222-225 MHz located on a primary "broadcast" site, then a simple system such as a Raspberry Pi 400 with an RTL-SDR dongle and a simple wire antenna cut for 222-225 MHz would work, and live Amateur Radio video content could be received.

Thanks to my friend Michael Sterba KG7HQ for mentioning this item.

Help Wanted - Documenting APRS Use Cases

Jeff Hochberg W4JEW on the APRS Foundation blog:

> **Your Mission…Should You Choose to Accept It**
>
> Plain and simple - tell us how you use APRS!
>
> - Why did you choose APRS over another protocol?
> - What benefits do you receive from it?
> - What sort of equipment do you need?
> - How does it need to be configured?
> - How do you interact with the equipment once it's configured?
> - How often do you use APRS?
> - What external systems have an effect (positive or negative)

I admire the energy of the APRS Foundation. It's been enthusiastically embraced by the APRS Community and 130+ people have become paid members, which has given the APRS Foundation a small budget for its expenses. It really seems to be working to start moving APRS forward again and evolving it to new capabilities.

APRS and the extensive infrastructure and very simple systems required to transmit information into the system is one of Amateur Radio's unique capabilities.

Ideas for APRS Foundation Request For Comments Process / System

Jeff Hochberg W4JEW on the aprssig email list:

> **IETF - RFC-like Process**
>
> We've discussed some ideas about how to facilitate healthy, productive conversations about where to take APRS next.
>
> It's safe to say that unless we have some semblance of process around this, these sorts of discussions can spiral out of control, and none of us want to see that happen.
>
> The challenge is in coming up with finding a process that fits the requirements of the APRS community.
>
> If anyone happens to have references they think would be helpful, please reach out via Contact Us form on the APRS Foundation website.
>
> https://www.aprsfoundation.org/contact-us/

This is another sign of the maturation of APRS and the APRS Foundation's determination to do things differently about expanding APRS, but doing so with more modern techniques and systems.

The Turn Island Systems WSPRSONDE v2 Is Here!

Paul Elliott WB6CXC for Turn Island Systems:

> It's alive!!! The new WSPRSONDE v2 WSPR/FST4W multichannel transmitters are rolling off the Turn Island Systems assembly line:

Image courtesy of Turn Island Systems

There are a few changes from the previous batch of WSPRSONDEs:

- Smaller chassis, customized for Turn Island Systems.
- Software control of output power: 1W or 250mW

There are a few other minor changes on the circuit board — things like Board Revision ID, allowing for future forward and backward compatibility.

But the WS-v2 is otherwise identical to the units that have been deployed on at least 2-1/2 continents. It continues to generate the clean, precise, and stable signals so necessary for accurate measurement of ionospheric propagation effects.

Along with this new hardware release comes updated WS firmware, with new features and options.

This has been in the works for a while now, and I am very pleased with the finished product!

This is yet another example of technological innovation in Amateur Radio. A year or two ago this was just an idea, but WB6CXC decided to try to turn the idea into reality, and now these systems are being installed around the world.

International EME Conference Archive on Digital Library of Amateur Radio & Communications

This is a full archive of all the data from the 2024 EME Conference held 2024-08-09 thru 11 in Trenton, New Jersey, USA, and some data from earlier conferences.

There are a lot of interesting presentations there from IEME 2024, including:

- EME Today and Tomorrow - Rick Rosen K1DS
- Story of EME - Its Evolution from 1940 to Present - Guy Gervais F2CT
- EME Fundamentals 2024 - Joe Taylor K1JT

and many more.

What the FCC's New Rule Means for Drones

Jack Daleo in Flying:

> **The agency last week voted to allow certain drone operations on a dedicated radio frequency spectrum, with the goal of improving safety and access.**
>
> The Federal Communications Commission has voted to adopt a set of initial rules for uncrewed aircraft systems (UAS)—more commonly known as drones—to use an exclusive radio frequency for operations.
>
> The FCC last week approved Part 88, which, for the first time, permits certain drone operations within a dedicated 5 GHz spectrum for wireless communications. Most drones fly on unprotected wireless frequencies—the same ones shared by your Wi-Fi router—which raises the risk of interference, such as through jamming.

> "Right now, drone operators largely rely on unlicensed airwaves to communicate with and control these uncrewed aircraft systems," said FCC Chairwoman Jessica Rosenworcel in a statement. "But the use of unlicensed spectrum leaves these aircraft more vulnerable to interference that could disrupt operations."
>
> …
>
> "Our actions today should enable UAS to be an effective tool in disaster recovery efforts," said Starks. "Although we establish a regulatory framework for UAS operating in radio line of sight of an operator, we also permit the use of some ground infrastructure deployment, such as a string of ground stations deployed over a particular and frequently used flight path."
>
> …
>
> To access the spectrum, drone operators will use the automated DFMS Rosenworcel alluded to. These systems manage spectrum availability and ensure safe use of the frequency.
>
> The DFMS will assign the operator a temporary frequency within a particular geographic area and time frame, specified by their UAS flight plan. Within that space and time, they would have exclusive and protected use of the band in controlled airspace and "other safety-critical circumstances," the FCC says.
>
> "By making additional spectrum available through such a framework, we ensure that spectrum is used efficiently and effectively while meeting the needs of UAS operations to be robust, reliable, and safe," said Starks. "That's real progress."

The spectrum in question is apparently 5030-5091 MHz. This is… pretty ingenious, actually. You have a drone flight scheduled from Point A to Point B from Time X to Time Y. So as part of scheduling that flight, your planning system checks into the Part 88 database, gets a frequency, that frequency is marked in the database as being in use from Point A to Point B from Time X to Time Y.

Another interesting aspect is that the system can be extended to permanent ground infrastructure… or not… the article wasn't quite clear on that. So just like a package delivery company knows where all of its vehicles are, via a (cellular) network, this system will (might?) enable drones to be remotely controlled from a central location via a network of Part 88 "remote base stations" instead of maintaining manual or local line of sight.

Well-Informed Commentary on the new FCC Part 88 (Dedicated Spectrum for Drones)

I reached out to Zero Retries reader Eric Grumling K0JEG for additional context on "FCC Part 88" from an Amateur Radio background. As you'll read, K0JEG has significant experience with drones and especially drone communications. He is the owner of Grand Valley Aviation, a semi-dormant5 startup company that designed a drone that can map Radio Frequency Interference (RFI) sources such as CATV leakage. K0JEG also writes an excellent newsletter titled Grand Valley Aviation; I'm a subscriber.

> The part 88 rules have been in discussion since 2018, when the initial language was part of the FCC reauthorization act. There will be two "bands" created, one for control point to drone and one for control to network to drone linking (analogous to simplex and repeater operation) . There will be at least one drone network provider that will likely build infrastructure on existing towers to support drone control and telemetry. Note that the definition of telemetry is strictly what's required to operate the aircraft, not video feeds or other payload data. Think lower speed data, text and control stick inputs. Last year I was at a drone conference when uAvionix learned of their type acceptance for their C-Band radios. You can read about their air radios here and ground station radios here. You're looking for the equipment labeled "Skystation-5060," those are the units that operate in the 5030-5091 MHz band.
>
> When I first started getting interested in drones and I heard they used ISM band radios I thought they were crazy. I've played around with long distance wifi and worked on my radio club's 3.0 GHz repeater link project, never imagining that 2.4/5Ghz would be suitable or reliable enough for drone flight. And for the most part, 2.4 GHz is a wasteland of lost links and flyaways. My one and only major crash was when I was flying close to an interstate and kept losing video when semis went by. I think they run some illegal "boosters" to get better wifi performance at the truck stop and just never turn 'em off. Eventually the drone lost link, and initiated a return to home into a big rock! But during the first generation radios that was fairly typical. And so were flyaways and crashes due to losing link.
>
> But since then the industry has come up with much better modulation, borrowing from LTE/5G radios and LDPC error correction. And moving to the 5 GHz ISM band helps too. There's much less interference from wifi systems only because they seem to stay fairly well contained in buildings. The ISP (and ham radio systems like our repeater links and ARDEN) are usually aimed and very directional so if they do cause problems it will usually only be for a few seconds, and I believe the drone radios should notch out the problem frequencies in their spreading algorithm, a lot of that is secret sauce...
>
> The holy grail of the small drone business is to get to beyond visual line of sight, or BVLOS. One of the big things holding it back is just how will the remote pilot actually fly the aircraft? There are several cellular network based solutions, I believe Honeywell's product uses the Iridium network and I'm sure there will be a few that use Starlink once SpaceX gets their gen2 (or is it gen3) satellites up in large numbers. The major holdup right now is who's responsible if the network goes down? uAvonix radios have redundancy built in with a dual C-band/LTE radio. This will likely be the solution for some time until the C-band network is built out and the lawyers come up with acceptable language in the contracts. Because even if you could get an SLA from a wireless provider it would still have plenty of ways for the ISP to weasel out of a service outage.
>
> But either way, the C-band isn't likely to be used for consumer and most part 107 commercial drones.
>
> Of course the Air Force figured all this stuff out decades ago with their UAV programs. The idea that someone sitting in Henderson NV (OK technically Nellis AFB) can pilot a drone that takes off in Saudi Arabia, flies a mission in Iraq and returns -and the pilot goes home at 5:00 to her family opens up a lot of possibilities. The FAA is under intense pressure to get this right. The FAA side of the program is 14CFR part 108, it's working its way through the system now.
>
> BTW, another use of the 900MHz band is for drone telemetry radios. I have a little FHSS pair that runs 56Kbps serial/USB between a drone and ground station PC. They're about the size of a matchbox and will talk for at least a mile or so with the stock stubby antenna.

K0JEG answered one of my most profound questions about drone communications prior to this new allocation of dedicated spectrum - *are they **nuts** for using unlicensed spectrum to communicate and control a moving object in the air???* At first, yes, they were, but not so much now, and his explanation of

the *reliable* use of unlicensed 5 GHz makes complete sense. I continue to be amazed at the innovation being applied to unlicensed spectrum… and Amateur Radio, of course.

Again, my thanks to K0JEG for his informed commentary.

---

20 Years Later, Real-time Linux Makes it to the Kernel - Really

Steven Vaughan-Nichols writing for ZDNET:

> [A Real Time Operating System - RTOS] is a specialized operating system designed to handle time-critical tasks with precision and reliability. Unlike general-purpose operating systems like Windows or macOS, an RTOS is built to respond to events and process data within strict time constraints, often measured in milliseconds or microseconds. As Steven Rostedt, a prominent real-time Linux developer and Google engineer, put it, "Real-time is the fastest worst-case scenario."
>
> He means that the essential characteristic of an RTOS is its deterministic behavior. An RTOS guarantees that critical tasks will be completed within specified deadlines. Many people assume that RTOSs are for fast processes. They're not. Speed is not the point in RTOSs -- reliability is. This predictability is crucial in applications where timing is essential, such as industrial control systems, medical devices, and aerospace equipment.
>
> …
>
> Real-time Linux has also proven useful in ways no one ever dreamed of at the start. Rostedt reminiscenced, "Back in 2005, I got a real-time bug report, and I sent a patch and said, 'Hey, here's the fix. Can you apply it?' And the guy's like, 'I don't know what I'm doing.' I replied, 'Wait, aren't you a kernel developer?' He replied, 'I'm a guitarist.'"
>
> Also: Linus Torvalds muses about maintainer gray hairs and the next 'King of Linux'
>
> It turned out he was using the early real-time patches because he was using JACK, the sound server for low-latency audio connections. He was using it because, like most musicians, he was too broke to buy high-end gear so, Rostedt continued, "he got a cheap laptop, with Linux and JACK, because with the real-time patch it would do good recording instead of skipping when the hard drive was writing."
>
> It turns out that a lot of musicians were early real-time Linux users because it let them produce high-quality recordings on the cheap. Who knew?

This caught my eye because of a comment of a modem developer for an Amateur Radio system some time ago (which I think I quoted in Zero Retries) that running a modem application on a general purpose computer and OS (such as VARA HF running on Windows) can be inferior to a dedicated modem appliance. That is because the modem application has to wait for the OS to cycle its multitasking to be delivered the data (from the audio interface) to the modem application. Granted the latency in a modern multi-GHz, multi-core computer operating a modern operating system is at worst case milliseconds, that can make a difference in the vagaries of a radio channel, especially of the HF bands. The developer made the point that modem software running on a dedicated processor might be a better choice because there wasn't any operating system latency - the processor was (typically) running "bare metal code" - just the modem application and nothing else.

Now, it seems, that running Real-time Linux is the best of all worlds:

- Easier development of modem code on a modern Operating System (with a network stack instead of that being a external system) instead of embedded systems programming,
- All the power of a Multi-GHz multiple core processor and multi-GB of memory such as a Raspberry Pi, and
- *Realtime* responsiveness from the OS for the modem code.

I'll guess that Real-time Linux will quickly be adopted by radio manufacturers such as FlexRadio whose radios actually run an in-radio operating system[6].

I hope these updates find their way into Raspberry Pi OS, but these days it's no big deal to run a Raspberry Pi as an appliance with a Linux (or other *nix) version other than Raspberry Pi OS.

This is just another of a series of advances that Amateur Radio can take advantage of with its rapidly evolving new competencies such as Software Defined Radio systems. If Software Defined Radio running on a host computer is good now… imagine how much better it could be running as Real-time?

WSPR Transmitter Construction And Programming

Bob Fontana AK3Y on his website:

> The WSPR transmitter was designed to be fully modular in construction. The unit consists of three (3) plug-in modules (ESP8266 NodeMCU microcontroller, SI5351 synthesizer subassembly and a user-selectable Low Pass Filter), together with a self-contained Temperature Compensated Crystal Oscillator (TCXO) which provides the necessary frequency stability for the design.
>
> The SI5351 synthesizer sub-module has been modified from its stock configuration. The on-board 25 MHz crystal has been removed (to be replaced by the outboard TCXO) and one of the output ports (Port 1) has been modified to be an input for the TCXO signal. This was done by cutting a single trace on the bottom of the module, and soldering a jumper connection from the previous crystal location. In addition, a 7 pin header has been soldered to the module.
>
> The following set of steps will illustrate how to assemble, program and test the transmitter. Please refer to the schematic and board layouts (transmitter and low pass filter) in Appendix A below. Also note the WSPR parts kit which is shown in Appendix B.

This is an interesting project(?) (kit?) but there's some context missing from this PDF document such as *where* to download the software for the processor:

Once downloaded, open the WSPR Transmitter code (WSPR_HF.ino).

Nor is it explained where to get the kit that is illustrated in this writeup. But it does seem to be a nice, interesting unit!

My thanks to Amateur Radio Weekly Issue 348 for mention of this item.

Leave a comment

Share

Join the *Fun* on Amateur Radio

If you're not yet licensed as an Amateur Radio Operator, and would like to join the fun by *literally having a license to experiment with radio technology*, check out
Join the Fun on Amateur Radio for some pointers.

Zero Retries Frequently Asked Questions (FAQs) — In development 2023-02.

Closing the Channel

In its mission to highlight technological innovation in Amateur Radio, promote Amateur Radio to techies as a literal license to experiment with radio technology, and make Amateur Radio more relevant to society in the 2020s and beyond, Zero Retries is published via email and web, and is available to everyone at no cost. Zero Retries is proud *not to participate* in the Amateur Radio Publishing Industrial Complex, which hides Amateur Radio content behind paywalls.

My ongoing ***Thanks*** to:

- Tina Stroh KD7WSF for, well, *everything!*
- ***Annual Founding Members*** **who generously support Zero Retries financially:**
  Founding Member 0000 - Steven Davidson K3FZT (Renewed 2024)

  Founding Member 0001 - Prefers to Remain Anonymous 01 (Renewed 2024)
  Founding Member 0002 - Chris Osburn KD7DVD (Renewed 2024)
  Founding Member 0003 - Don Rotolo N2IRZ (Renewed 2024)
  Founding Member 0004 - William Arcand W1WRA (Renewed 2024)
  Founding Member 0006 - Todd Willey KQ4FID (Renewed 2024)
  Founding Member 0007 - Merik Karman VK1DF / VK2MKZ (Renewed 2024 *with* ***two*** *Founding Member subscriptions!*)
  Founding Member 0008 - Prefers to Remain Anonymous 14
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  Founding Member 0011 - Rick Prelinger W6XBE
- Numerous Annual and Monthly subscribers who also generously support Zero Retries financially!

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- The *most* effective way to support Zero Retries is to simply mention Zero Retries to your co-conspirators that are also interested in knowing more about technological innovation that is occurring in Amateur Radio and encourage them to become a fellow subscriber.
- One particularly effective method of promoting Zero Retries is to add a mention of Zero Retries to your QRZ page (or other web presence) and include a link:

  https://www.zeroretries.org
- If you'd like to financially support Zero Retries, becoming a paid subscriber is *greatly* appreciated and helps offset expenses incurred in publishing Zero Retries. Paid subscriptions for Zero Retries are *entirely optional*, as explained in this special issue of ZR:
  Zero Retries Administrivia - Activating Payment Options.

These blogs and newsletters regularly feature Zero Retries Interesting content:

- Dan Romanchik KB6NU mentions "Zero Retries Interesting" topics so regularly on his blog (that I otherwise wouldn't know about) that I've bestowed on him the honorific of Pseudostaffer.
- Jeff Davis KE9V also mentions "Zero Retries Interesting" topics so regularly on his blog (that I otherwise wouldn't know about) that I've bestowed on him the honorific of Pseudostaffer.
- Amateur Radio Weekly by Cale Mooth K4HCK is a weekly anthology of links to interesting Amateur Radio stories that often feature "Zero Retires Interesting" topics.
- Experimental Radio News by Bennet Z. Kobb AK4AV discusses (in detail) Experimental (Part 5) licenses issued by the US FCC. It's a *must-read-now* for me!
- RTL-SDR Blog - *Excellent* coverage of Software Defined Radio units.
- TAPR Packet Status Register has been published continuously since 1982.
- Hot Iron - The Journal of the Constructor's Club is a delightful quarterly newsletter.

- Other Substack Amateur Radio newsletters recommended by Zero Retries.

These YouTube channels regularly feature Zero Retries Interesting content:

- HB9BLA Wireless by Andreas Spiess HB9BLA
- KM6LYW Radio by Craig Lamparter KM6LYW (home of the DigiPi project)
- Modern Ham by Billy Penley KN4MKB
- Tech Minds by Matthew Miller M0DQW

These podcasts regularly feature Zero Retries Interesting content:

- Store and Forward - a podcast about the past and future of amateur radio, by Kay Savetz K6KJN (curator of the Digital Library of Amateur Radio and Communications) and Steve Stroh N8GNJ (Editor of Zero Retries).
- Ham Radio Workbench by George Zafiropoulos KJ6VU (and friends)
- Foundations of Amateur Radio by Onno Benschop VK6FLAB

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Social Media:

Zero Retries (N8GNJ) is on Mastodon — n8gnj@mastodon.radio — just click:

Zero Retries / N8GNJ on Mastodon

Zero Retries (N8GNJ) is also on Bluesky — @n8gnj — just click:

Zero Retries / N8GNJ on Bluesky

Email issues of Zero Retries are "instrumented" by Substack to gather basic statistics about opens, clicking links, etc.

More bits from Steve Stroh N8GNJ:

- **SuperPacket blog** — *Discussing new generations of Amateur Radio Data Communications - beyond Packet Radio (a precursor to Zero Retries)*
- **N8GNJ blog** — *Amateur Radio Station N8GNJ and the mad science experiments at N8GNJ Labs in Bellingham, Washington, USA*

Thanks for reading!
Steve Stroh N8GNJ / WRPS598 (He / Him / His)
These bits were handcrafted (by a mere human, not an Artificial Intelligence bot) in beautiful Bellingham (The City of Subdued Excitement), Washington, USA, and linked to the Internet via **Starlink *Satellite* Internet Access**.

2024-09-27

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Footnotes for this Issue

1

The BCM-144 radio was, unfortunately, recently discontinued by Bridgecom Systems.

2

A Canadian Zero Retries reader who's a member of Radio Amateurs of Canada (RAC) has read my previous articles about a GEO Amateur Radio payload / satellite for North America, saw that article, and shared a (one time) copy of that issue with me. No, I won't "reshare" that issue - please don't ask.

3

Fast scan full motion television.

4

What about Linux, MacOS, Raspberry PI? This project only supports Windows on the x86 and x64 hardware. There are absolutely no plans whatsoever to support any other operating system or hardware.

5

Dormant - Ran out of money and talent. **What an investment opportunity!** When you need to locate Radio Frequency Interference, you need that solved ***now*** and "driving around" a metro area in traffic trying to triangulate on an RFI source, versus a drone being able to "home in" on a source of RFI from the air is a no-brainer better solution to this issue.

6

Proprietary software versus Open Source Software taken into consideration, of course.